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(71) Applicant(s)
Tai-Her Yang
5-1 Taipin Street, Si-Hu Town, Dzan-hwa, Taiwan

(72) Inventor(s)
Tai-Her Yang

(74) Agent and/or Address for Service
Withers & Rogers
4 Dyer's Buildings, Holborn, LONDON, EC1N 2JT,
United Kingdom

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GB 1543445 A DE 003200753 A1

(58) Field of Search
UK CL (Edition K ) H2J JLX JSAX JSVP JSVV
INT CL[5] H02P 7/28 7/282
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# (54) Electic motor control arrangement

(57) A speed control arrangement for a series (or compound) motor has a series field winding S101 including intermediate taps. A choke diode CR101 is connected between the power supply and the field winding S101, an energy storage diode CR102 and capacitor C101 is connected in parallel with the field winding and a shunt switch device Q101 - Qn is connected between the power supply and each tap. When the switch device is off motor armature current will be conducted by the series field winding in full. When the switch device is on the power supply current will be conducted by the switch device eg Q101 to shunt part(s) of the field winding(s). The speed is controlled depending on the ratio of on time to off time of each switch device. In addition the shunt ratio can be controlled by a feedback signal of current or running speed. The switch device Q101 - Qn may be a thyristor or switch transistor.

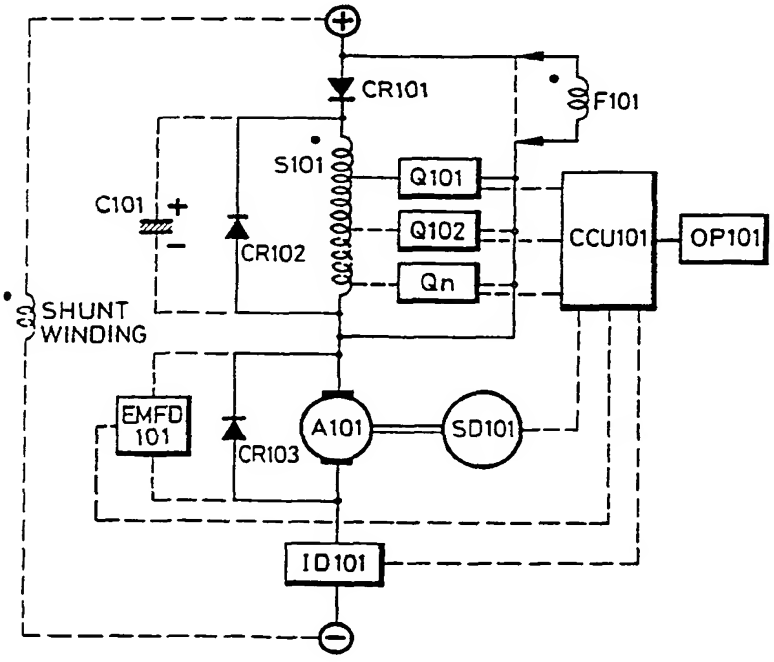


FIG. 1

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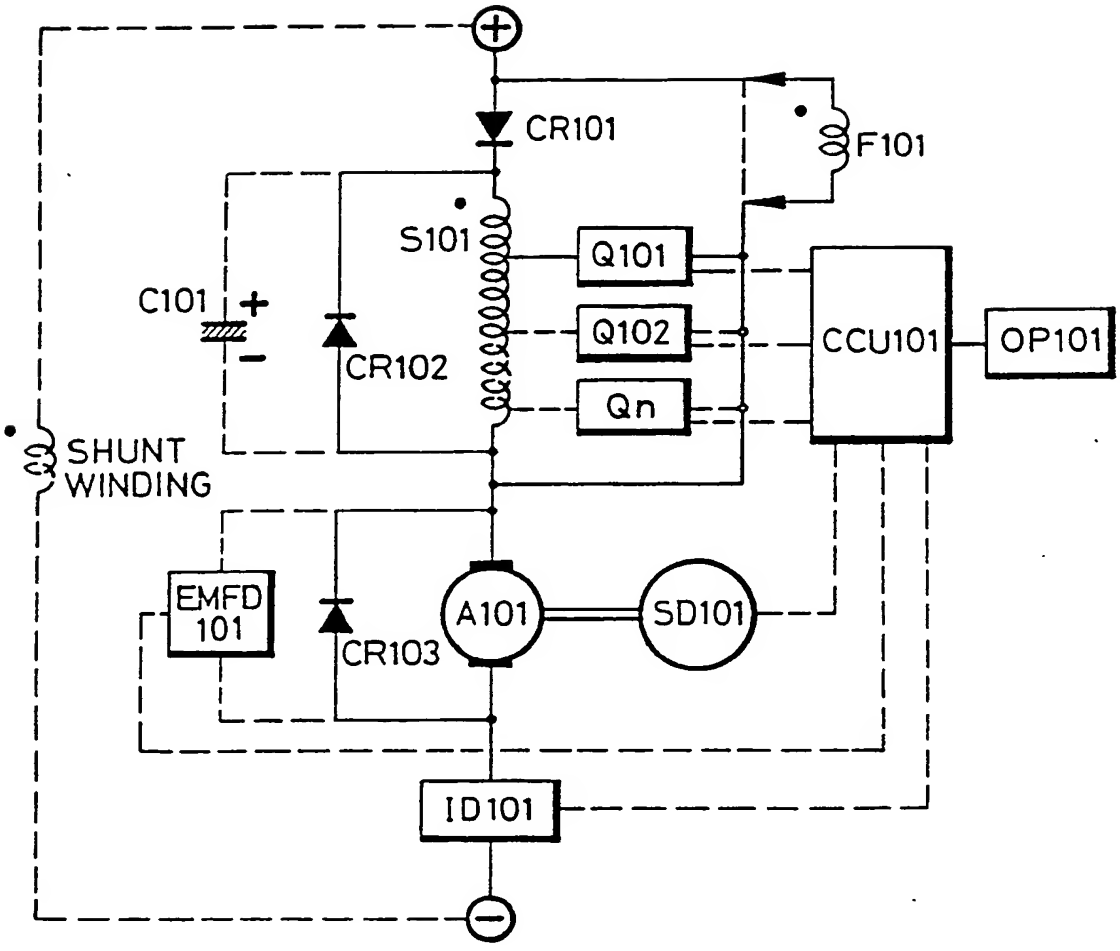
CR101
F101
S101
Q101
C101
Q102
CCU101
OP101
CR102
Qn
SHUNT
WINDING
EMFD
101
A101
SD101
CR103
ID101

FIG. 1

TITLE

A Multi-step Changeover Type Series (or Compound) Fi ld Winding For Shunt Motor Speed Control Circuit Having Transient Storage Effect.

## SUMMARY OF THE INVENTION

The present multi-step changeover type series (or compound) field winding for shunt motor speed control circuit having transient storage effect relates to a series field winding having plural intermediate taps, series with a choke diode between with the power supply and parallel connnecting an energy storage diode, capacitor, etc., and a shunt switch device for carrier control is parallel connected between the power supply and each tap, when the controlled switch device is broken circuit, motor armature current will pass by the series field winding in full; when the switch device is conducted the power supply current will be shunted by the controlled switch device leading to the armature through the other series windings or directly leading to the armature while the field is excited continuously with the storage element in order to advance armature voltage under much stable flux intensity depending on the ratio of conducting time to broken circuit cycle by the control of each shunt switch device and further to control the speed of motor. Some part of series winding may be parallel connected to the shunt switch device and the remainings maintain series with armature in order to meet a flexible requirement, or a plural series field winding taps matching a plural shunt switch device in order to select turn ratio of relatively controlled winding; in addition

shunt ratio can be controlled with the feedback signal of current or running speed. The shunt switch device required by the present design may comprise matured thyristor or switch transistor.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a basic circuit diagram showing the multi-step changeover type series (or compound) field winding of shunt motor speed control circuit having transient storage effect.

## DETAILED DESCRIPTION OF THE INVENTION

The series (or compound) motor has been widely applied to various kinds of household appliances, electrical loaders and machines because of the characteristics such as easy speed control and excellent current/torque. However for various kinds of speed control circuits for series motors, the series field shunting method is advantageous for advancing armature voltage without the change in flux intensity while a greater output of motor is achieved. However, provided as a linear impedance for shunting, such as resistance or linear power element, it is defected with power loss and the decrease of field excitation, and even a great power loss will involve when motor has much great horsepower.

The present multi-step changeover type series (or compound) field winding for shunt motor speed control circuit having transient storage effect relates to a series field winding having plural intermediate taps, series with a choke diode between with the power supply and parallel

connnecting an energy storage diode, capacitor, etc., and a shunt switch device for carrier control is parallel connected between the power supply and each tap, wh n the controlled switch device is broken circuit, motor armature current will pass by the series field winding in full; when the switch device is conducted the power supply current will be shunted by the controlled switch device leading to the armature through the other series windings or directly leading to the armature while the field is excited continuously with the storage element in order to advance armature voltage under much stable flux intensity depending on the ratio of conducting time to broken circuit cycle by the control of each shunt switch device and further to control the speed of motor. Some part of series winding may be parallel connected to the shunt switch device and the remainings maintain series with armature in order to me t a flexible requirement, or a plural series field winding taps matching a plural shunt switch device in order to select turn ratio of relatively controlled winding; in addition shunt ratio can be controlled with the feedback signal of current or running speed. The shunt switch device required by the present design may comprise matured thyristor or switch transistor.

The embodiment of the present design is described as below:

Referring to FIG. 1, a basic circuit diagram showing the multi-step changeover type series (or compound) field winding of shunt motor speed control circuit having transient storage effect, comprising:

the series field winding S101 for series (or compound)

motor including at least one intermediate tap is series with armature A101 wherein series field winding S101 is parallel connected to flywheel diode CR102 and further parallel connected to storage capacitance C101; armature A101 may be parallel connected to flywheel diode CR103 or omitted;

a choke diode CR101 positively series with the series field winding S101 while the positive end of power supply is leading to the series field winding by virtue of choke diode and armature A101 is leading to the negative end of power supply;

at least one or more solid-state switch device Q101 ~ Qn comprises solid-state switch transistor or thyrsistor, and its positive end which positively conducts current is directly parallel connected to the positive end of power supply, and its output end is connected to the connection between the series field winding S101 and armature A101 or leading to the intermediate tap of series winding, or a plural series field winding taps matching a plural shunt switch device in order to select turn ratio of relatively controlled winding; the solid-state switch device Q101 may further be jointly series with auxiliary exciting winding F101;

a CCU101 to provide for open-circuit driving for producing cyclic driving signal or for producing relatively conducting and broken circuit driving pulse with reference to setting and feedback values so as to control any selected of solid-state switch device, i.e. to select any of switch devices Q101 ~ Qn for relatively cyclic ON/OFF driving, alternative ON/OFF driving by two or more switch devices in order to reduce series field current pulsation;

a speed detector SD101 may comprise analogical or numerical sensing elements and be coupling with armature A101 and for sending relatively analogical or numerical signal to armature speed back to CCU101; the said speed detector SD101 also can be replaced by armature EMF detector EMFD101 for giving speed reference signal;

load current detector ID101 may transmit analogical or numerical signal to CCU101;

operation interface OP101 for manual or communication signal input is provided for speed control operation of CCU101 against the power switch device Q101.

The said circuit is a basic circuit. The present multi-step changeover type series (or compound) field winding of shunt motor speed control circuit having transient storage effect may be manually controlled or controlled with feedback signal(s) from load current detector or speed detector or EMF detector or the combination of two or more means above mentioned.

Except for series motors, the said circuit can be applicable to the compound motors having series windings.

To conclude above statement, the present multi-step changeover type series (or compound) field winding for shunt motor speed control circuit having transient storage effect concerns less thermal loss than the conventional linear power elements or resistance employed as shunt type speed control for series field winding, which is characterized in by that, field intensity concerns higher stability by means of multi-step cycle changeover of series field winding having intermediate taps and shunt switch device and by virtue of storage element and choke diode and further to

promote motor performance and suitability. It provides an innovation and utility. Please examine it in accordance with the laws.

CLAIMS

1. A multi-step multi-step changeover type series (or compound) field winding for shunt motor speed control circuit having transient storage effect relates to a series field winding having plural intermediate taps, series with a choke diode between with the power supply and parallel connnecting an energy storage diode, capacitor, etc., and a shunt switch device for carrier control is parallel connected between the power supply and each tap, when the controlled switch device is broken circuit, motor armature current will pass by the series field winding in full; when the switch device is conducted the power supply current will be shunted by the controlled switch device leading to the armature through the other series windings or directly leading to the armature while the field is excited continuously with the storage element in order to advance armature voltage under much stable flux intensity depending on the ratio of conducting time to broken circuit cycle by the control of each shunt switch device and further to control the speed of motor, including:

the series field winding S101 for series (or compound) motor including at least one intermediate tap is series with armature A101 wherein series field winding S101 is parallel connected to flywheel diode CR102 and further parallel connected to storage capacitance C101; armature A101 may be parallel connected to flywheel diode CR103 or omitted;

a choke diode CR101 positively series with the series field winding S101 while the positive end of power supply is leading to the series field winding by virtue of choke diode

and armature A101 is leading to the negative end of power supply;

at least one or more solid-state switch device Q101 ~ Qn comprises solid-state switch transistor or thyrsistor, and its positive end which positively conducts current is directly parallel connected to the positive end of power supply, and its output end is connected to the connection between the series field winding S101 and armature A101 or leading to the intermediate tap of series winding, or a plural series field winding taps matching a plural shunt switch device in order to select turn ratio of relatively controlled winding; the solid-state switch device Q101 may further be jointly series with auxiliary exciting winding F101;

a CCU101 to provide for open-circuit driving for producing cyclic driving signal or for producing relatively conducting and broken circuit driving pulse with reference to setting and feedback values so as to control any selected of solid-state switch device, i.e. to select any of switch devices Q101 ~ Qn for relatively cyclic ON/OFF driving, alternative ON/OFF driving by two or more switch devices in order to reduce series field current pulsation;

a speed detector SD101 may comprise analogical or numerical sensing elements and be coupling with armature A101 and for sending relatively analogical or numerical signal to armature speed back to CCU101; the said speed detector SD101 also can be replaced by armature EMF detector EMFD101 for giving speed reference signal;

load current detector ID101 may transmit analogical or numerical signal to CCU101;

operation interface OP101 for manual or communication signal input is provided for speed control operation of CCU101 against the power switch device Q101;

except for series motors, the said circuit can be applicable to the compound motors having series windings.

2. The multi-step changeover type series (or compound) field winding of shunt motor speed control circuit having transient storage effect according to claim 1, shunt ratio can be controlled with the feedback signal of current or running speed, the shunt ratio may be controlled through feedback signal(s) from load current detector or speed detector or EMF detector.

3. The multi-step series (or compound) field winding of shunt motor speed control circuit having transient storage effect according to claim 1, which may be manually controlled or controlled with feedback signal(s) from load current detector or speed detector or EMF detector or the combination of two or more means above mentioned.

**Patents Act 1977**
**Examiner's report to the Comptroller under Section 17 (The Search Report)**

Application number
GB 9218670.9

**Relevant Technical fields**

(i) UK Cl (Edition K ) H2J (JSAX,JSVV,JSVP,JLX)

(ii) Int Cl (Edition 5 ) H02P 7/28, 7/282

Search Examiner
B J EDE

**Databases** (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search
9 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1-3

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| X | GB 1543445 (SHINKO ELECTRIC) see F1, F2, F3, S1-S3 Figure 3 | 1 |
| X | DE 3200753 A1 (AKO-WERKE) see 2,4,5 and 7 | 1 |

| | ...ocument and relevant passages | Relevant to claim(s) |
|---|---|---|
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